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# Structural and dynamic properties of polyoxyethylene sorbitan monooleate micelle in water dispersion studied by pulsed field gradient NMR

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## Abstract

The diffusion phenomenon of a nonionic surfactant, polyoxyethylene sorbitan monooleate (POE-SMO), micelle in aqueous solution was investigated by pulsed field gradient nuclear magnetic resonance (PFG NMR) with a high gradient strength of 17.4 T/m at the diffusion time td varied from 3 to 300 ms. This high gradient strength allowed us to measure the slow self-diffusion coefficient of POE-SMO micelle, and the short diffusion time below 10 ms showed the restricted diffusion of the micelle. At the short td the self-diffusion of the micelle was restricted and the restricted sizes were 1.8, 1.5, and 0.8 μm for the POE-SMO concentration of 100, 200 and 300 mM, respectively, and 0.6 μm for the POE-SMO only. The possible reason of this restriction was assumed to be the formation of a spatial network or a micellar clustering. Furthermore, a proton exchange between water molecule and surfactant OH group on the micelle surface was proposed. With respect to this proposal, the residence time of the proton at the micelle surface and the thickness of the surface were investigated from proton self-diffusion coefficients by PFG NMR. 